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Applicants: Peter HEIN et al.
Int'l Application No.: PCT/DE03/01666
Application No.: **NEW APPLICATION**
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For: COMPUTER TOMOGRAPHY UNIT WITH A DATA
RECORDING SYSTEM

LETTER

U.S. Patent and Trademark Office
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December 7, 2004

Sir:

Amended sheets are attached hereto (which correspond to Article 34 amendments or to claims attached to the International Preliminary Examination Report), as required by 35 U.S.C. § 371(c)(3). The Article 34 amended sheets are incorporated in the included substitute specification and Preliminary Amendment.

Respectfully submitted,

HARNESS, DICKY & PIERCE, P.L.C.

By: _____

Donald J. Daley, Reg. No. 34,313

DJD:smk

P.O. Box 8910
Reston, Virginia 20195
(703) 668-8000

Patent Claims

1. A computer tomography unit having an X-ray beam source (1) and having a radiation detector (4) which
 5 has a number of detector elements (6a-6x), having a data acquisition system (10) for reading the electrical signals which are produced by the detector elements (6a-6x) and for processing them to form raw data, and having an image computer (12) which is arranged
 10 downstream from the data acquisition system (10) and to which the raw data can be supplied via a data transmission path (11),

characterized by
 an evaluation device (18) which is designed for
 15 automatic assessment of the quality of the radiation detector (4) and, in addition, for automated assessment of the quality of the data acquisition system (10) and/or of the data transmission path (11), wherein the evaluation device (18) can carry out the following
 20 steps:

- a) initiation of at least one measurement for production of raw data with the X-ray beam source (1) switched off,
- b) using the raw data, calculation of at least one
 25 value of a signal offset of the radiation detector (4),
- c) driving of a display device (20) in order to display an evaluation result in which the calculated value is included.

30
 2. A computer tomography unit having an X-ray beam source (1) and having a radiation detector (4) which has a number of detector elements (6a-6x), having a data acquisition system (10) for reading the electrical
 35 signals which are produced by the detector elements (6a-6x) and for processing them to form raw data, and having an image computer (12) which is arranged

downstream from the data acquisition system (10) and to which the raw data can be supplied via a data transmission path (11), characterized by.

- 5 an evaluation device (18) which is designed for automatic assessment of the quality of the radiation detector (4) and, in addition, for automated assessment

of the quality of the data acquisition system (10) and/or of the data transmission path (11), wherein the evaluation device (18) can carry out the following steps:

- 5 a) initiation of a number of measurements for production of raw data, in which case it is possible to automatically change the drive or setting of the X-ray beam source (1) between at least two measurements,
- 10 b) using the raw data, calculation of at least one value of at least one parameter which allows a quality statement about the radiation detector (4),
- 15 c) driving of a display device (20) in order to display an evaluation result in which the calculated value is included.

3. The computer tomography unit as claimed in claim 2,
20 characterized in that the parameter describes spectral linearity or signal linearity of the radiation detector (4).

4. The computer tomography unit as claimed in one of
25 claims 1 to 3, characterized in that the evaluation device (18) can compare the calculated value with a tolerance limit which can be predetermined or is read from a memory (21).

30 5. The computer tomography unit as claimed in one of claims 1 to 4,
characterized in that the evaluation result can be displayed graphically on the display device (20), in particular with two or more parameters being combined
35 to form a graphical pattern.

6. The computer tomography unit as claimed in one of

claims 1 to 5,
characterized by a memory device (22) for storage of the
evaluation result.

7. The computer tomography unit as claimed in one of claims 1 to 6, characterized in that a further parameter can be determined which is suitable for assessment of the quality of the data acquisition system (10), of a component, of a module element or of a subarea of the data acquisition system (10).

8. The computer tomography unit as claimed in claim 7, characterized in that the parameter is suitable for assessment of an electronics channel which is associated with a detector element, in particular for assessment of an integrator (30a-30x) in the electronics channel, for assessment of a monitor channel, for assessment of a demultiplexer (31), or for assessment of an A/D converter (33).

9. The computer tomography unit as claimed in one of claims 1 to 6, characterized in that a further parameter can be determined which is suitable for assessment of the data transmission path (11).

10. The computer tomography unit as claimed in one of claims 1 to 9, characterized in that the evaluation device determines the value of the parameter statistically from the measured raw data.

11. The computer tomography unit as claimed in one of claims 1 to 10, characterized in that the evaluation device is implemented by driving by means of appropriate software which, in particular, is provided in a computer (16), in particular in a control computer, which is fitted away from the gantry (7).

Patent Claims

1. A computer tomography unit having a radiation detector (4) which has a number of detector elements (6a-6x), having a data acquisition system (10) for reading the electrical signals which are produced by the detector elements (6a-6x) and for processing them to form raw data, and having an image computer (12) which is arranged downstream from the data acquisition system (10) and to which the raw data can be supplied via a data transmission path (11), characterized by an evaluation device (18) for automated assessment of the quality of the data acquisition system (10) and/or of the data transmission path (11).

2. The computer tomography unit as claimed in claim 1, characterized in that the evaluation device (18) is additionally designed for automatic assessment of the quality of the radiation detector (4).

3. The computer tomography unit as claimed in claim 1 or 2, characterized in that the following steps can be carried out by the evaluation device (18):

- a) initiation of one or more measurements for production of raw data,
- b) using the raw data, calculation of at least one value of at least one parameter which allows a quality statement,
- c) driving of a display device (20) in order to display an evaluation result in which the calculated value is included.

4. The computer tomography unit as claimed in claim 3,

characterized in that the evaluation device (18) can compare the calculated value with a tolerance limit which can be predetermined or is read from a memory 21.

5. The computer tomography unit as claimed in claim 3 or 4,

characterized in that the evaluation result can be displayed graphically on the display device (20), in particular with two or more parameters being combined to form a graphical pattern.

6. The computer tomography unit as claimed in one of claims 3 to 5,

10 characterized by

a memory device (22) for storage of the evaluation result.

7. The computer tomography unit as claimed in one of claims 3 to 6,

15 characterized in that the parameter is suitable for assessment of the quality of the data acquisition system (10), of a component, of a module element or of a subarea of the data acquisition system (10).

8. The computer tomography unit as claimed in claim 7,

20 characterized in that the parameter is suitable for assessment of an electronics channel which is associated with a detector element, in particular for assessment of an integrator (30a-30x) in the electronics channels, for assessment of a monitor channel, for assessment of a demultiplexer (31), or for assessment of an A/D converter (33).

9. The computer tomography unit as claimed in one of claims 3 to 6,

30 characterized in that

the parameter is suitable for assessment of the data transmission path (11).

10. The computer tomography unit as claimed in one of

claims 3 to 6,
characterized in that the parameter is suitable for
assessment of the quality of the radiation

detector (4), in particular for assessment of a single detector element (6a-6x) in the radiation detector (4).

5 11. The computer tomography unit as claimed in claim 10,
characterized in that
the parameter describes a signal offset.

10 12. The computer tomography unit as claimed in claim 10,
characterized in that the parameter describes spectral
linearity or signal linearity.

15 13. The computer tomography unit as claimed in one of claims 3 to 12,
characterized in that the evaluation device determines
the value of the parameter statistically from the
measured raw data.

20 14. The computer tomography unit as claimed in one of claims 1 to 13,
characterized in that the evaluation device is
implemented by driving by means of appropriate software
which, in particular, is provided in a computer (16),
25 in particular in a control computer, which is fitted
away from the gantry (7).

Patentansprüche

1. Computertomographiegerät mit einer Röntgenstrahlenquelle
(1) und mit einem mehrere Detektorelemente (6a-6x) aufweisen-
5 den Strahlungsdetektor (4), mit einem Datenerfassungssystem
(10) zum Auslesen der von den Detektorelementen (6a-6x) er-
zeugten elektrischen Signale und deren Verarbeitung zu Rohda-
ten und mit einem dem Datenerfassungssystem (10) nachgeordne-
ten Bildrechner (12), welchem die Rohdaten über eine Daten-
10 übertragungsstrecke (11) zuführbar sind,
g e k e n n z e i c h n e t, d u r c h
eine Auswerteeinrichtung (18), die zur automatischen Beurtei-
lung der Qualität des Strahlungsdetektors (4) und zusätzlich
zur automatisierten Beurteilung der Qualität des Datenerfas-
15 sungssystems (10) und/ oder der Datenübertragungsstrecke (11)
hergerichtet ist, wobei von der Auswerteeinrichtung (18) fol-
gende Schritte durchführbar sind:
- a) Auslösen wenigstens einer Messung zur Erzeugung von Rohda-
ten bei abgeschalteter Röntgenstrahlenquelle (1),
 - 20 b) unter Verwendung der Rohdaten Berechnung wenigstens eines
Wertes eines Signal-Offsets des Strahlungsdetektors (4),
 - c) Ansteuerung einer Anzeigeeinrichtung (20) zur Darstellung
eines Auswerteergebnisses, in das der berechnete Wert ein-
fließt.
- 25
2. Computertomographiegerät mit einer Röntgenstrahlenquelle
(1) und mit einem mehrere Detektorelemente (6a-6x) aufweisen-
den Strahlungsdetektor (4), mit einem Datenerfassungssystem
(10) zum Auslesen der von den Detektorelementen (6a-6x) er-
30 zeugten elektrischen Signale und deren Verarbeitung zu Rohda-
ten und mit einem dem Datenerfassungssystem (10) nachgeordne-
ten Bildrechner (12), welchem die Rohdaten über eine Daten-
übertragungsstrecke (11) zuführbar sind,
g e k e n n z e i c h n e t, d u r c h
35 eine Auswerteeinrichtung (18), die zur automatischen Beurtei-
lung der Qualität des Strahlungsdetektors (4) und zusätzlich
zur automatisierten Beurteilung der Qualität des Datenerfas-

sungssystems (10) und/ oder der Datenübertragungsstrecke (11) hergerichtet ist, wobei von der Auswerteeinrichtung (18) folgende Schritte durchführbar sind:

- a) Auslösen mehrerer Messungen zur Erzeugung von Rohdaten, wobei zwischen wenigstens zwei Messungen selbsttätig eine Änderung der Ansteuerung oder Einstellung der Röntgenstrahlenquelle (1) vornehmbar ist,
- b) unter Verwendung der Rohdaten Berechnung wenigstens eines Wertes von mindestens einem eine Qualitätsaussage über den Strahlungsdetektor (4) erlaubenden Parameter,
- c) Ansteuerung einer Anzeigeeinrichtung (20) zur Darstellung eines Auswerteergebnisses, in das der berechnete Wert einfließt.

3. Computertomographiegerät nach Anspruch 2, dadurch gekennzeichnet, dass der Parameter eine spektrale Linearität oder eine Signallinearität des Strahlungsdetektors (4) beschreibt.

4. Computertomographiegerät nach einem der Ansprüche 1 bis 3, dadurch gekennzeichnet, dass von der Auswerteeinrichtung (18) ein Vergleich des berechneten Wertes mit einer vorgebbaren oder aus einem Speicher (21) ausgelesenen Toleranzgrenze durchführbar ist.

5. Computertomographiegerät nach einem der Ansprüche 1 bis 4, dadurch gekennzeichnet, dass das Auswerteergebnis grafisch auf der Anzeigeeinrichtung (20) darstellbar ist, wobei insbesondere mehrere Parameter zu einem grafischen Muster zusammengefasst sind.

6. Computertomographiegerät nach einem der Ansprüche 1 bis 5, gekennzeichnet, durch eine Speichereinrichtung (22) zum Abspeichern des Auswerteergebnisses.

7. Computertomographiegerät nach einem der Ansprüche 1 bis 6,
d a d u r c h g e k e n n z e i c h n e t, dass ein wei-
terer Parameter ermittelbar ist, der zur Beurteilung der Qua-
lität des Datenerfassungssystems (10) oder einer Komponente,
5 eines Teilmoduls oder eines Teilbereichs des Datenerfassungs-
systems (10) geeignet ist.

8. Computertomographiegerät nach Anspruch 7,
d a d u r c h g e k e n n z e i c h n e t, dass der Pa-
10 rameter zur Beurteilung eines einem Detektorelement zugeord-
neten Elektronikkanals, insbesondere zur Beurteilung eines
Integrators (30a-30x) des Elektronikkanals, zur Beurteilung
eines Monitorkanals, zur Beurteilung eines Demultiplexers
(31) oder zur Beurteilung eines A/D-Wandlers (33) geeignet
15 ist.

9. Computertomographiegerät nach einem der Ansprüche 1 bis 6,
d a d u r c h g e k e n n z e i c h n e t, dass ein wei-
terer Parameter ermittelbar ist, der zur Beurteilung der Da-
20 tenübertragungsstrecke (11) geeignet ist.

10. Computertomographiegerät nach einem der Ansprüche 1 bis
9,
d a d u r c h g e k e n n z e i c h n e t, dass die Aus-
25 werteeinrichtung den Wert des Parameters statistisch aus den
gemessenen Rohdaten ermittelt.

11. Computertomographiegerät nach einem der Ansprüche 1 bis
10,
30 d u r c h g e k e n n z e i c h n e t, dass die Auswerte-
einrichtung durch Ansteuerung mittels einer entsprechenden
Software realisiert ist, die insbesondere in einem außerhalb
der Gantry (7) angebrachten Computer (16), insbesondere in
einem Steuerrechner, vorhanden ist.